_M-PA_ Amateur

Operator's Manual

for
Code Revision 0397

Manual Revision 1.00

The M-PA Amateur software is used to convert an Ericsson M-PA model handheld radio from a commercial unit into an Amateur radio. It removes the requirement for the special programming interface unit and PC software to program operating parameters into the _M-PA_. Thus, allowing front keypad programming of the radio. The _M-PA_ also has many Amateur Radio features that the commercial version does not have.

This software also _**ELIMINATES**_ the radio's FCC commercial type acceptance! This means that the radio cannot legally be operated outside the ham bands once this software is loaded. This conversion is _**NOT**_ a product of Ericsson, Inc., but is the result of private efforts by individuals Amateurs to create a truly commercial quality Amateur handheld radio.

This manual will guide you through the operation of the _M-PA_ with the ham software installed. If you are familiar with the commercial M-PA's operation, you can now forget most of what you know. The _M-PA_ will work more like a standard ham radio than a commercial radio.

Text in italics denotes latest manual revision changes

DISPLAY

1)   ALPHA-NUMERIC:

Eight characters capable of displaying letters or numbers.

2)   TOP ROW ANNUNCIATORS

EMG - Not Used in *M-PA*

NC - Not Used in *M-PA*

HI - Indicates channel is programmed in High Power mode

MSG - Not Used in *M-PA*

T99 - Indicates channel in Weather Alert mode

CNV - Indicates radio scans all banks

SPC - Indicates Battery Save Active

PVT - Not Used in *M-PA*

3)   BOTTOM ROW ANNUNCIATORS

TX - Indicates radio is Transmitting

BSY - Indicates radio is Receiving (useful in CG mode)

CG - Indicates radio is in Channel Guard mode

BAT - Indicates Low Battery

S - Indicates channel is programmed as a Regular Scan channel

2 - Indicates channel is programmed as the Priority Two channel

1 - Indicates channel is programmed as the Priority One channel

SCN - Indicates radio is Scanning

TOP CONTROLS:

1)   **Volume Knob:**

This should be self-explanatory! The Power switch is on the battery pack.

2)   **Channel Selector:**

Sixteen channel rotary knob. Selects operating channel.

3)   **Red Button:**

On the M-PA radio, this is the emergency button. On the _M-PA_, this has been reprogrammed. In receive mode, the red button duplicates the blue Monitor Button (except during power-on). This is very useful if the _M-PA_ is placed into the Vehicular Charger, since the monitor button is blocked. In transmit mode, it will send the programmable Morse ID.

LEFT SIDE:

1)   PTT Switch:

The Push To Talk switch is in the middle of the left side.

2)   Monitor Button:

This is the small oval blue button. If it is held for less than two seconds, it will open the   squelch. If it is held for greater than two seconds, it will temporarily remove the receive Channel Guard. The receive Channel Guard can be restored by again pressing and holding the blue button for greater than two seconds, or switching to another channel and   back. Hint: Look for the CG flag in the display.

On a Weather Alert channel, pressing and holding the Monitor Button for greater than two seconds will remove the T99 decode. The weather broadcast can then be monitored.   To restore the T99 decode, press and hold the Monitor Button for more than two   seconds. Hint: look for the T99 flag in the display.

If the blue monitor button is held when power is applied, the radio will enter the Setup Menu. As long as the Monitor Button is held during power-on, the microcode release level is displayed. (i.e. I0397Mxx)

3)   Universal Device Connector:

This is the accessory port. It has power in, audio in/out, PTT, etc. It is used with Speaker Microphones, Vehicular Chargers, etc. It is also used to update the flash memory with new code revisions.

4)   Antenna Connector:

Used to direct the RF to an external antenna, without having to remove the portable antenna.

FRONT PANEL:

1)   MENU (STEP) Button:

Used to step through the options.

2)   SEL (SCAN) Button:

Used to select an option from the menu to set.

3)   EXIT (SPC) Button:

Used to enter the new value for the selected option. Also used in receive mode to temporarily remove a channel from the scan list or skip up during band scan.

4)   SCAN (2ⁿᵈ) Button:

Used to start and stop the radio scanning. Also used to select the scan level (P1, P2, normal) in scan programming mode.

5)   Numeric Keypad:

Used to enter values for programming options in receive mode. Used to send DTMF tones in transmit mode. *Pressing the '1' key while in Rx standby mode will display the   battery voltage in the left two digits of the display*

STANDARD MENU

NOTE: Do not attempt to program the radio with it scanning! The new setting is likely to affect any channel in the scan list, and not the one you want it to.

CHN BANK

Pressing the SEL button results in the message 'BANK 1-4'. It expects an input of 1, 2, 3, or 4. This will select which of the four, sixteen channel banks the rotary knob will access. The radio can scan all 64 channels. However, having more than sixteen scan channels will slow the scan loop down to the point where short transmissions are missed.

SCAN OPT

Pressing the SEL button results in the display of 'B0 A1 V2'.

Pressing the selected number and 'EXIT' will enable that scan mode.

The options are:

0 = Scan only the selected bank of 16 channels 1 = Scan all 64 channels (the CNV flag will activate)

2 = VFO Band scan without the channel busy alert beep

3 = VFO Band scan with the channel busy alert beep

4 = VFO band scan with automatic store

See the section titled 'scanning' for details on operating the band scanner.

TX FREQ

Pressing the SEL button results in the message 'KHZ'. It expects six digits to program the desired transmit frequency (i.e. 146520 will program 146.520 MHz). If too few digits are entered, a 'NO LOCK' message will flash and the unit will beep during transmit. This means that the synthesizer cannot lock. Re-enter a valid transmit frequency.

RX FREQ

Pressing the SEL button results in the message 'KHZ'. It expects six digits to program the desired receive frequency (i.e. 146520 will program 146.520 MHz). If too few digits are entered, a 'NO LOCK' message will flash and the unit will beep during receive. This means that the synthesizer cannot lock. Re-enter a valid receive frequency. Note that the radio will be very slow to accept keyboard entries when this occurs. Turning the volume control all the way down will speed up the entry process.

STANDARD MENU (cont)

TX CG

Pressing the SEL button results in the display of the current CG, or 'NONE'. Enter the desired CG value from the table in Appendix B, or the integer value of the CG frequency (i.e. 114 will get 114.8 Hz). Use the value of '0' for no CG.

RX CG

Pressing the SEL button results in the display of the current CG, or 'NONE'. Enter the desired CG value from the table in Appendix B, or the integer value of the CG frequency (i.e. 114 will get 114.8 Hz). Use the value of '0' for no CG.

SCAN A/D

Pressing the SEL button results in the display of the current receive frequency. Pressing the SCAN button selects 'S' (reg scan), '2' (priority 2), '1' (priority 1) or 'blank' (not in scan list) along the bottom on the display. Pressing EXIT programs the value to that channel. If there was a priority set on a channel already, and a new channel is selected for that priority value, the previous priority channel is set to a regular scan channel automatically.

POWER

Pressing the SEL button results in the display of either the LO or HI power setting for that channel. Repeatedly pressing SEL will toggle between HI and LO power.

LOCK

Pressing the SEL button results in the display of 'LOCKED' if the radio keypad was unlocked, or 'UNLOCKED' is the radio was locked. Repeatedly pressing SEL will toggle selection.

PHONE

Pressing the SEL button will step through the programmed autodial numbers. If the PTT is pressed while an autodial number is in the display, the number is dialed. Press EXIT after dialing, or you will send the number again!

PHN EDIT

Pressing the SEL button will step through the programmed autodial numbers (10 total). Use the numeric keypad to enter the desired number. Press EXIT to store the new number into memory.

CH LABEL

Pressing the SEL button results in the message 'ASCII IN'. It expects two digit ASCII characters from Appendix A. The resulting ASCII string will replace the receive frequency display for each channel programmed with a channel label. If you enter less characters than are currently displayed, the balance of the previous characters will remain.

SETUP MENU

This menu is accessed by holding the blue Monitor Button while powering up the radio.

CHN BANK

Pressing the SEL button results in the message 'BANK 1-4'. It expects an input of 1, 2, 3, or 4. This will select which of the four, sixteen channel banks the rotary knob will access. Currently, the radio can scan across all four banks. However, having more than sixteen scan channels (total) will slow the scan loop down to the point where short transmissions are missed.

BATT SAVE

NOTE: There needs to be a hardware modification performed to the main logic board before the Battery Saver will function! See appendix E.

Pressing the SEL button results in the display of 'SAVE 1 0' Enter a '1' to activate, or a '0' to deactivate the function. The 'SPC' flag in the display will indicate that the battery save algorithm is active. The battery saver will nearly double the battery life in receive mode. The battery saver does not function on a channel with the Weather Alert function enabled, a channel with a carrier active with an incorrect CG tone, or in scan mode. Since the battery saver functions by shutting the receiver down if there is no activity, the actual battery life becomes tied to channel activity. There will be a delay between the time a channel becomes active and the radio receives it (approx ½ second). Also, there will be a delay before a keypress is detected (also ½ second) in battery save mode.

SCAN OPT

Pressing the SEL button results in the display of 'B0 A1 V2'.

Pressing the selected number and 'EXIT' will enable that scan mode.

The options are:

0 = Scan only the selected bank of 16 channels 1 = Scan all 64 channels (the CNV flag will activate)

2 = VFO Band scan without the channel busy alert beep

3 = VFO Band scan with the channel busy alert beep

4 = VFO band scan with automatic store

See the next section titled 'scanning' for details on operating the scanner.

SETUP MENU (cont)

VFO MODE

Pressing the SEL button results in the display of 'ENABLE 1'. Pressing '1' will enable the VFO tuning mode. Pressing '0' will disable the VFO mode. VFO mode operates by allowing the receive frequency to be altered in 5 KHz steps. Press the '*' key to decrement and the '#' key to increment the frequency. When using VFO mode, the TX frequency is set to the same as the RX. A different TX frequency can be entered via the TX FRQ menu (same as normal). Note that any change in the RX freq. will reset the TX frequency. The VFO mode will work on any channel. NOTE: The channel label feature cannot be used when operating in VFO mode

AUTO OFF

Pressing the SEL button results in the display of 'ENABLE 1'. Pressing the desired number key, then EXIT will enable the desired automatic repeater offset / DTMF mode:

0: No automatic repeater offset / Continuous DTMF mode

1: Automatic repeater offset / Continuous DTMF mode

2: No automatic repeater offset / Burst DTMF mode

3: Automatic repeater offset / Burst DTMF mode

The automatic repeater offset operates with 146 MHz and 440 MHz models only. It sets the proper transmitter offset for a given receive freq. as per the ARRL band plans. If a different transmit freq. is desired, it can be entered manually. This is especially useful when using the band scan and VFO modes to find repeaters.

The offsets work as follows:

Below 145.100 = No Offset
145.100 - 145.495 = -600 KHz Offset
145.500 - 146.595 = No Offset
146.600 - 146.995 = -600 KHz Offset
147.000 - 147.395 = +600 KHz Offset
Above 147.400 = No Offset

Below 442.000 = No Offset
442.000 - 444.995 = +5 MHz Offset
445.000 - 446.995 = No Offset
447.000 - 449.995 = -5 MHz Offset
Above 450.000 = No Offset

There is a bug in the masked ROM code that drops CTCSS for several cycles when sending continuous DTMF. This screws up autopatches and repeater controllers that use CTCSS on their receivers. The only fix to this is to use DTMF burst mode (like the autodialer does).

SETUP MENU (cont)

HI PWR

Pressing the SEL button results in the display of the current High power setting in Hexadecimal. However, it expects a decimal value to program (hope your hex conversion skills aren't rusty!).

LO PWR

Pressing the SEL button results in the display of the current Low power setting in Hexadecimal. However, it expects a decimal value to program.

TX MOD

Pressing the SEL button results in the display of the current transmit modulation setting in Hexadecimal. However, it expects a decimal value to program.

SQULCH

Pressing the SEL button results in the display of the current squelch setting in Hexadecimal. However, it expects a decimal value to program. Note that you will need to set the squelch higher when using the scanner

MORSE ID

Pressing the SEL button results in the message 'ASCII IN'. It expects two digit ASCII characters from Appendix A. The resulting ASCII string will be sent in 800 Hz AFSK when the red button is pressed while transmitting.

SETUP MENU (cont)

RAD TYPE

Pressing the SEL button results in the message '49 54 60'. It expects two digits. 49 = 150 MHz, 50 = 220MHz, 54 = 440 MHz, 60 = 900 MHz. Enter the desired radio type and press EXIT. A RESET must be performed for this to take effect.

RESET

Pressing the SEL button results in the message 'TO xxxxxx', where 'xxxxxx' is the default frequency for the band selected by 'RAD TYPE'. All channels will be reset to the default frequency for that band. Also, all power, squelch and deviation settings will be reset to their default values.

SIDETONE

Pressing the SEL button results in the display of 'TONE 1 0'. Pressing '1' & 'EXIT' will enable the DTMF sidetone. Pressing '0' & 'EXIT' will disable the DTMF sidetone. This feature is most useful on 628 series logic boards, with their full volume sidetone. (default = 1)

WTHERALT

Pressing the SEL button results in the display of 'ALRM 1 0'. Pressing '1' & 'EXIT' will enable the 1050 Hz NOAA weather alert tone decoder. Pressing '0' & 'EXIT' will disable the NOAA alert function. This is useful on 2m units. One channel can be programmed for the local NOAA station and only severe weather alerts will be heard. Using the blue Monitor button will temporarily remove the NOAA alert. Once an alert has been decoded, the radio will monitor the weather channel for five minutes before resetting. Manual reset can be done by pressing the blue button for 1 second or more, or by changing the channel knob. Weather alert function does not work in scan mode.

BATTERY METER

Pressing the '1' key on the keypad while in standby mode will cause the battery voltage to be displayed in the left two digits of the LCD. It reads in 0.1 volt increments with a range of 6.0 to 8.9 volts. The value will remain in the display until a function key is pressed, the radio transmits, or the channel is changed. The value does not update automatically. Nominal battery voltage is 7.5 volts. Any voltage above 8.9 volts will read as 8.9 volts. The meter is accurate to +/- 0.1 volt
in the middle of the range. The accuracy is less at the ends of the range. The low battery flag works as always.

SCANNING

The *M-PA* has five different scanning modes, selected via the SCAN OPT menu selection. The modes are as follows:

Option 0 - Conventional *M-PA* dual priority scan - 16 channel, single bank.

Option 1 - Conventional *M-PA* dual priority scan - 64 channels.

Option 2 - VFO scan (see details below).

Option 3 - VFO scan with receive activity beep.

Option 4 - VFO scan with beep and automatic store.

Options 0 and 1 allow scanning of the memory channels, either 16 channels in one of four banks, or all 64 channels. Options 2,3, and 4 allow for scanning between user programmable start and stop frequencies in 5 KHz steps.

Conventional Memory Channel Scanning:

The *M-PA* has a Dual Priority scan. This means that there are 4 levels of scan available to any particular channel. The scanner is *very* fast and powerful. The scanner is activated via the SCAN key.

Each channel can be programmed to be in the scan list. There are four levels of memory scan, selected via the SCAN option from the main menu. All 64 channels can be scanned, or divided into four banks of 16, with the 16 channels scanned within a bank.

The first level of scanning is No Scan. If a channel is not programmed with 1,2, or S in the display, it will not be scanned.

The second level of scanning is a Regular Scan channel. A channel at this level of scanning will be denoted by an 'S' in the display. There can be up to 64 channels at this level, but scan loop time becomes too long if more than 16 total channels are programmed in the scan list.

The third level of scanning is Priority Two scan. Only one channel can be set to this level. If a channel is set to P2, and it becomes active, the receiver will switch from any Regular Scan channel to the P2 channel.

The fourth level of scanning is Priority One scan. Only one channel can be set to this level. If a channel is set to P1, and it becomes active, the receiver will switch from a Regular Scan channel or the P2 channel to the P1 channel.

A short cutout of a Regular Scan or P2 channel (when active) will be noted. This is the scanner checking the P2 and/or P1 channels while receiving the Regular Scan or P2 channel.

The EXIT button can be used to temporarily remove a Regular Scan (S) channel from the Scan List. If an inane conversation should erupt on a scanned channel, press the EXIT button while the channel is active. That channel is temporarily removed. If the scanner is stopped and restarted, the channel is restored to the list.

Neither of the Priority Channels can be temporarily removed. If a Regular Scan channel is selected by the rotary knob, it cannot be temporarily removed. Only one channel can be removed at a time. If another channel is deleted by pressing EXIT, the first channel is restored to the list and the second one removed.

SCANNING (cont)

VFO Programmable Band Scanning:

The _M-PA_ scanner can be used to scan every 5 KHz between any two user programmable start and stop frequencies. The start frequency is entered into channel 63 (bank 4, ch 15) and the stop frequency is entered into channel 64 (bank 4, channel 16). A 'skip' frequency can be entered into channel 62 (bank 4, channel 14). If no skip is desired, program channel 62 to a frequency outside the band scan limits.

Once scan option 2, 3 or 4 is selected, and the start, stop and 'skip' frequencies entered, press the SCAN key. The _M-PA_ will go to the start frequency and start scanning upwards in 5 KHz steps. Once the stop frequency is reached, the frequency will reset back to the start freq. and scanning will continue. The radio will continue to loop until the SCAN key is again pressed (the PTT will not stop the scanner).

When an active channel is located, the radio will stop scanning and stay on that frequency until 0.8 seconds after the squelch closes. If scan option 3 is selected, the radio will emit a short beep to alert the user that it has found some activity. This is useful for quiet sections of spectrum.

The EXIT key can be used to skip past an unwanted active channel. If the unwanted signal is particularly strong, more than one keypress may be necessary to move past the signal. If the radio is also in VFO mode, the * or # key can be used to store the active channel into the memory selected by the knob.

If option 4 is selected, and VFO mode is active, the radio will automatically program the active frequency into the channel selected by the knob. The radio will stop scanning once it stores the frequency into memory. Of course, the scanner can be restarted by pressing the SCAN key. The knob will have to be set to a different auto-store channel, or the first frequency may be overwritten by a different frequency. If VFO mode is disabled, no automatic store will occur.

Notes, Cautions and Warnings:

Make sure that the scanner is disabled (regardless of mode) before programming any of the normal radio parameters. If the scanner is active the data entered is likely to wind up in any memory location, rather than the area one intends it for!

Note that for Priority Scan to function properly, the squelch will need to be set higher than it would for no scanning. If the squelch is set too loose, an oscillation to the Priority 1 or 2 channels will be noticed. This is caused by the squelch being slow to close, and the scanner seeing a busy channel. As soon as the squelch closes, the scanner sees an inactive channel and resumes scan, only to stop again due to the open squelch. It will soon drive you crazy!

There can be only one Priority 1 and Priority 2 channel for all 64 channels regardless of scanner option setting. This means that if you select single bank scanning, and have the priorities set in a different bank, the priorities are still scanned across the banks. The user will need to manually reprogram the two priority channels when switching banks.

Alpha labels cannot be used on channels 62, 63 or 64 and still be used for programmable band scanning.

APPENDIX A: <u>M-PA</u> Ham Code release levels

Release	Function
0894a	DTMF sidetone switch
0894b	TXID sidetone switch
0894c	Alphanumeric labels
0894d	Weather Alert decode
0894e	Weather Alert auto-reset
0894f	220 reset fix
0994	Nuisance Delete
1094	Direct CG entry
0295	CH1 Nuisance Delete fix
0395	Four channel banks (64 ch)
0595	Battery saver
0695	Bank scan option
0795	VFO mode & bank scan flag
0795a	Band Scanning
0895	Band Scanning w/ skip
0397	Auto repeater offset; DTMF bug fix; Battery meter; 900 MHz synth fix

APPENDIX B: <u>M-PA</u> ASCII Table

CHARACTER	ASCII VALUE
0	48
1	49
2	50
3	51
4	52
5	53
6	54
7	55
8	56
9	57
/	58
A	65
B	66
C	67
D	68
E	69
F	70
G	71
H	72
I	73
J	74
K	75
L	76
M	77
N	78
O	79
P	80
Q	81
R	82
S	83
T	84
U	85
V	86
W	87
X	88
Y	89
Z	90

APPENDIX C: _M-PA_ Channel Guard Tones

INDEX	FREQ
0	NONE
1	67.0
2	69.3
3	71.9
4	74.4
5	77.0
6	79.7
7	82.5
8	85.4
9	88.5
10	91.5
11	94.8
12	97.4
13	100.0
14	103.5
15	107.2
16	110.9
17	114.8
18	118.8
19	123.0
20	127.3
21	131.8
22	136.5
23	141.3
24	146.2
25	151.4
26	156.7
27	162.2
28	167.9
29	173.8
30	179.9
31	186.2
32	192.8
33	203.5
34	206.5
35	210.7
36	218.1
37	225.7
38	229.1
39	233.6
40	241.8
41	250.3
42	254.1

Note: Due to the roll off of _M-PA_ filters, receive channel guard tones greater than 229.1 Hz may have poor decode sensitivity.

APPENDIX D: Creating an <u>M-PA</u>

LBI-38377 is the recommended service manual for M-PA. It is helpful to have one on hand before modifying radios.

Basically, the creation of a <u>M-PA</u> from a M-PA requires having the front part of an EDACS trunked 'system' model radio and the rear RF section from a conventional model M-PA or M-TL radio. The trunking logic board is required to run the M-AH software, and the conventional RF section is required for 146, 220 or 440 ham bands.

The 900 MHz version uses a 900 MHz trunked radio as a starting point.The trunked RF section requires modifications to operate in the 902 MHz to 928 MHz ham band (see appendix F).

The 220 MHz version uses a 174 MHz conventional RF section, which requires substantial modifications to operate at 220 MHz. It also requires the EDACS logic section (see appendix G).

Currently there are two flash files which accommodate either EDACS Platform: HAM628.BPD and HAMVGB.BPD.

HAM628.BPD will support radios equipped with the 19D902628Gx or the 19D903078Gx controller boards.

HAMVGB.BPD will support radios equipped with 19D903081Gx controller board. If using a 19D903081Gx board make sure that the small plug in voice encryption board is removed.

Both files support the 146, 220, 450, and 900 MHz bands. This allows for mixing and matching of controllers and RF sections. The 146 MHz RF section of choice is 19C337097G2 (146-162) for coverage of both the HAM and commercial high band frequencies. If only Ham band coverage is desired, then 19C337097G1 (136-150) will do just fine. The 900MHz 19C337097G9 RF section requires hardware mods. For 220 MHz, special conversion of the 19C337097G3 (162-174) VHF RF section is required.

Once the radio is assembled and flash programmed, the personality must be "RESET". To do this, power the radio on while holding the side blue button in. The software version number should appear in the display and then disappear as the blue button is released. Use the MENU key to menu to the "RAD TYPE" menu. Press SELect and three choices should appear in the display; 49 (146), 54 (450), and 60 (900). The choice of 50 (220) is valid, but not displayed. Enter the desired type and press EXIT.

Now MENU to the "RESET" menu and press SELect. All 16 channels will be reset to the frequency shown in the display. Press EXIT and the RESET will occur. For 220MHz, Version I1293Mxx or later is required. For default 220 MHz tables, version I0894fMxx or later is required.

Note that the 081, Voice Guard Board will take quite a long time to complete the RESET command. The software must write default data for the selected band to a fairly slow EEPROM. The 628 board resets in a couple of seconds, since it is programming a fast SRAM.

Default values of tracking data were used at RESET. If adjustment is required, use the set of alternate MENUs that are available when the radio is powered up while holding the side blue button. These menus are "HI PWR", "LO PWR", "TX MOD" and "SQUELCH",

When any of the tracking data menus are SELected, the current hex value appears in the display. New values must be entered in decimal, however.

APPENDIX E: <u>M-PA</u> Battery Saver Modifications

Controller board modification for super battery save mode: The hardware modification involves adding a jumper from an unused processor port pin. This allows the microprocessor to turn off almost all of the radio short periods of time to save a great amount of current drain. The response time of the squelch will be slowed down so this battery saver will not be usable for packet.

Locate the 68HC705 and 80C52 processors on the main logic board.

Different versions of logic boards may have microprocessors located in different places (the LBI is helpful). On the 68HC705 processor lift up or break off pin 14 (don't destroy the pad on the board). Add a jumper from the 80C52 processor pin 40 to the pad that pin14 of the 68HC705 used to connect to. This completes the modification.

APPENDIX F: <u>M-PA</u> 900 MHz Modifications

Basically, the 900 MHz <u>M-PA</u> is made from an EDACS 900 MHz M-PA by loading the M-AH software into the flash memory on the M-PA logic board. A speed up of the synthesizer section is required, Follow these instructions:

1- Change U15 from a P3 VCO to a P1 VCO (as used on the original TMX mobiles). Tack solder the new VCO in place to test the range for proper operation, since some P1 VCO's do not cover the ham repeater band.
2- Change R45 from 47k to 68k. Check the output of the Q11 regulator circuit. It should be approx. 6.0 volts after the resistor change. Adjust the value of R45, if necessary. If it is less than 5.9 volts, the VCO may not operate in the repeater band. If it is greater than 6.1 volts, the regulator will not properly regulate and transmit hum and noise will result.
3- Remove R54 and jumper across R39 and R40.
4- Break the VCO control line between Q8 and R22. Add a silicon diode with the cathode end attached to R22. Place a 22uF tantalum capacitor across the diode (positive end attached to the anode). make sure that these components do not short to the casting when assembled. Use a physically small capacitor (4v or so).
5- Add a 10k resistor to ground at the cathode end of the diode.
6- Cut the trace from the emitter of Q8 going to U9 pins 1 and 8.
7- Connect U9 pins 1 and 8 to the cathode of the diode.

Notes:

The control line voltage (emitter of Q8) should be above 1.2 volts for consistent PLL locking at the lowest desired transmit frequency. This is dependant on the specific VCO used. The synthesizer may not lock when going from transmit to receive if the control voltage is too low.

The VCO bandswitch line is always low in receive and high in transmit modes. This allows the radio to receive down to about 915 MHz and up to about 935 MHz. Transmit will cover from about 908 MHz to about 940 MHz. Note that the receive sensitivity is poor below 918 MHz due to the receiver front and filters.

APPENDIX G: <u>M-PA</u> 220 MHz Modifications

These modifications are still under development.